

Child Protection Evidence Systematic review on Bites

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While the format of each review has been revised to fit the style of the College and amalgamated into a comprehensive document, the content remains unchanged until reviewed and new evidence is identified and added to the evidence-base.

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Summary

This systematic review evaluates the scientific literature on abusive and non-abusive bites in children published up until **June 2014** and reflects the findings of eligible studies. The review aims to answer the following clinical question:

- Is this an abusive bite?

Bites are a relatively common injury to children, with approximately 1/600 children attending A&E having been bitten by humans^{1,2}. Many of these will be caused by other children. An abusive bite, however, is unique among physical injuries since it can potentially identify (or exclude) a specific perpetrator, occasionally enhanced by DNA retrieval³⁻⁵. This review aims to characterise the clinical features of an abusive bite so that it can be recognised by clinicians, to enable appropriate forensic dental referral.

Recent years have seen publications detailing forensic evaluation of bites in adults and children. Unfortunately these have not provided detailed information on the abusive bites of children in isolation⁶. No new studies have sought to characterise the features of bites in children.

Key findings:

- A human bite on a child should be suspected if there is any 2-5cm oval / circular injury, with a circumscribed annular border, with or without central ecchymosis
- Any suspicious lesion must have photographs taken with a right-angled measuring device and these need to be taken in each plane if the injury is on a curved surface
- Early referral of suspicious injuries to forensic dentists is mandatory to enable possible identification of a specific perpetrator

Background

This systematic review evaluates the scientific literature on abusive and non-abusive bites in children published up until June 2014 and reflects the findings of eligible studies. The review aims to answer the following clinical question:

1. Is this an abusive bite?

Methodology

A literature search was performed using a number of databases for all original articles and conference abstracts published since 1950. Supplementary search techniques were used to

identify further relevant references. See [Appendix 1](#) for full methodology including search strategy and inclusion criteria.

Potentially relevant studies underwent full text screening and critical appraisal. To ensure consistency, ranking was used to indicate the level of confidence that abuse had taken place and also for study types.

Findings of clinical question 1: Is this an abusive bite?

- Of 171 studies reviewed (four foreign language articles), five studies were included⁷⁻¹¹

Age

- Ranging 0-18 years for the group, as a whole
- Four cases were aged less than 30 months
- The fifth case was in their late teenage years

Gender

- two boys, three girls
- No study addressed disabled children

Influence of ethnicity and socio-economic group

- One child noted to be white, no details on the other cases
- No detail on socio-economic group

Details of included studies

In all included cases children had suffered physical abuse and the bite was confirmed by a forensic dentist.

- Case 1:
 - Child noted in foster care to have a vivid discoloured bite mark to the abdomen⁷
 - Clinical photograph taken; although the photo did not contain the appropriate measuring device, it was still possible to derive the width, central ecchymotic area and lengths of linear marks from incisal edges⁷
 - Examination of three potential suspects confirmed the grandmother to be the only possible perpetrator⁷
 - This case highlights the importance of early accurate photography⁷

- Case 2:
 - 30/12 old child with four day history of annular lesions, initially diagnosed as ringworm⁸
 - Dermatologist confirmed the lesions were bites due to their shapes and patterns⁸
 - Dental impressions excluded family members; nursery staff were suspected. This resulted in a forensic dental assessment⁸
 - This case highlights the importance of seeking further opinion and dental casts by forensic dentists⁸
- Case 3:
 - 10/12 old child with lesions to back of the tongue, characteristic arc shape with concave surface pointing labially. This case could, therefore, not have been self induced⁹
 - Intercanine distance was consistent with an adult bite from six days earlier⁹
 - Associated injuries included multiple fractures and intracranial injury⁹
 - This case highlights the importance of noting exact contours and measurements⁹
- Case 4:
 - A six-week-old murdered infant, noted to have three lesions with oval marks, central sparing with slight ecchymosis and no abrasions¹⁰
 - Arch size and slightly oval bite pattern are consistent with a child's dentition; absent permanent teeth and deciduous molars indicated it was caused by child aged 2 1/2 – 6 years¹⁰
 - A four and a half year old child was identified as the perpetrator out of 37 possible contacts¹⁰
 - In the absence of the bite, the child would not have been considered as a possible perpetrator¹⁰
- Case 5:
 - A teenage girl was assaulted and bitten on her hand¹¹
 - Distinguishing features of the bite: two arcs joined at a diffuse larger mark; one fairly continuous lesion with four separate components – two circular marks, two elongated next to each other. The elongated marks were caused by upper central incisors, the circular marks were caused by canines¹¹
 - The intercanine distance of 23mm suggests abnormal teeth, thus enabling identification of the suspect¹¹
 - This case was the first report of a bite on a child assisting forensic identification¹¹

1.1 Features which suggest that a skin lesion on a child is a bite⁷⁻¹¹

- An annular appearance of the lesion made by two opposing concave arcs
- Irregularities within the arc secondary to individual tooth characteristics
- A central ecchymotic area within the bite mark can occur

- Individual characteristics within the bite mark can be further analysed by forensic dentists to assist in identifying or excluding perpetrators

1.2 Implications for practice

- A human bite on a child should be suspected if there is any 2-5cm oval / circular injury, with a circumscribed annular border, with or without central ecchymosis
- Any suspicious lesion must have photographs taken with a right-angled measuring device and these need to be taken in each plane if the injury is on a curved surface
- Early referral of suspicious injuries to forensic dentists is mandatory to enable possible identification of a specific perpetrator

1.3 Research implications

Further research is needed in the following areas:

- To confirm standard intercanine measurements used clinically
- To validate the characteristics described in international guidelines in a large-scale study

1.4 Limitations of review findings

- Poor quality evidence
- No case-control studies
- Small numbers of children
- Lack of any confirmation of standard diagnostic criteria for diagnosis of bites
- Several studies describing large numbers of children with bites did not meet our inclusion criteria since there were no details as to confirmation that the injury was a bite

Other useful resources

The review identified a number of interesting findings that were outside of the inclusion criteria. These are as follows:

Clinical question 1

- Measurement of intercanine distance to distinguish child and adult bites:
 - Less than 2.5 cm: child (deciduous teeth)¹²
 - 2.5 – 3.0 cm: child or small adult¹²
 - 2.5 – 4.5 cm: human¹²
 - Greater than 3.0cm: adult¹²
 - However, there is considerable racial, sexual and individual variation¹³

- Adult dentition reached at 12 years¹³
- Features of carnivorous animal bites:
 - Variable size¹⁴
 - Puncture wounds spaced in relation to canines¹⁴
 - Tear rather than compress flesh¹⁴
- Gender:
 - Boys and girls under 10 years old were equally likely to suffer abusive bites¹⁵
- Retaliation:
 - Three children bit their attackers¹⁵
- Location:
 - The commonest sites for abusive bites were arms (29%), legs (19%), shoulder (10%), back (8.5%), buttocks and face equal (7%)¹⁵
- Tracing perpetrators:
 - An integrated technique increases the likelihood of identifying the perpetrator of a bite¹⁶

Related publications

No additional material published arising from the bites review.

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Appendix 1 – Methodology

We performed an all-language literature search of original articles, their references and conference abstracts published since 1950. The initial search strategy was developed across OVID Medline databases using keywords and Medical Subject Headings (MeSH headings) and was modified appropriately to search the remaining bibliographic databases. The search sensitivity was augmented by the use of a range of supplementary ‘snowballing’ techniques including consultation with subject experts and relevant organisations, and hand searching selected websites, non-indexed journals and the references of all full-text articles.

Standardised data extraction and critical appraisal forms were based on criteria defined by the National Health Service’s Centre for Reviews and Dissemination¹⁷. We also used a selection of systematic review advisory articles to develop our critical appraisal forms¹⁸⁻²². Articles were independently reviewed by two reviewers. A third review was undertaken to resolve disagreement between the initial reviewers when determining either the evidence type of the article or whether the study met the inclusion criteria. Decisions related to inclusion and exclusion criteria were guided by Cardiff Child Protection Systematic Reviews, who laid out the basic parameters for selecting the studies.

Our panel of reviewers included paediatricians, paediatric dentists, designated and named doctors and specialist nurses in child protection. All reviewers underwent standardised critical appraisal training, based on the CRD critical appraisal standards¹⁸, and this was supported by a dedicated electronic critical appraisal module.

Inclusion criteria

General criteria

Inclusion	Exclusion
Articles of all evidence types	Personal practice
English and non-English articles	Review articles
Patients between 0-17 years of age	Studies where the population included adults and children but where we could not extract data that applied solely to children
Oral injury defined as the vermilion border of the lips to the hypopharynx	Single case reports of abusive torn frenum or intra-oral injury (from 2008)
Abusive oral injury	Methodologically flawed papers
Torn labial frenum of any aetiology	Rank of abuse 4 (only rank 5 pre-2008)
	Dental neglect

Oral injury due to sexual abuse or intentional thermal injury
Complications or outcome of abusive oral injury

Ranking of abuse

Distinguishing abuse from non-abuse is central to our review questions. As our reviews span more than 40 years, standards for defining abuse have changed markedly. We have devised the following ranking score where “1” indicates the highest level of confidence that abuse has taken place. These rankings are used throughout our systematic reviews (where appropriate).

Ranking	Criteria used to define abuse
1	Abuse confirmed at case conference or civil or criminal court proceedings or admitted by perpetrator
2	Abuse confirmed by stated criteria including multidisciplinary assessment
3	Abuse defined by stated criteria
4	Abuse stated but no supporting detail given
5	Suspected abuse

Ranking of accident

Ranking of evidence by study type	
A1	Independently witnessed accidental cause or forensic recreation of scene
A2	By confirmation of organic disease (diagnostic test and / or diagnosis from clinical profile)
B1	By multi-disciplinary assessment and child protection clinical investigation
B2	Consistent account of accident by the same individual over time
B3	By checking either the child abuse register or records of previous abuse
C1	Accidental cause / organic diagnosis stated but no detail given
C2	No attempt made to exclude abuse / no detail given

Ranking of evidence by study type

Ranking of evidence by study type

T1	Randomised controlled trial (RCT)
T2	Controlled trial (CT)
T3	Controlled before-and-after intervention study (CBA)
O1	Cohort study / longitudinal study
O2	Case-control study
O3	Cross-sectional
O4	Study using qualitative methods only
O5	Case series
O6	Case study
X	Formal consensus or other professional (expert) opinion (automatic exclusion)

Definition of levels of evidence and grading practice recommendations

Ranking	Level	Criteria used to define abuse
A	Ia	Evidence obtained from a well designed randomised controlled trial of appropriate size (T1)
B	Ib	Evidence obtained from a well designed controlled trial without randomisation (T2, T3)
B	IIa	Evidence obtained from a well designed controlled observational study e.g. cohort, case-control or cross-sectional studies. (Also include studies using purely qualitative methods) (O1, O2)
C	IIb	Evidence obtained from a well designed uncontrolled observational study (O3, O4)
C	III	Evidence obtained from studies that are case series or case studies (O5, O6)

Search strategy

The below table presents the search terms used in the 2014 Medline database search for bites, truncation and wildcard characters were adapted to the different databases where necessary.

1. Child/	31. ((intraoral or oral or dental) adj3 (abrasion: or (abrasion: or lesion: or laceration:)).mp.
2. (toddler: or baby or infant: child: or babies).mp.	32. (bite: adj5 injury).mp.
3. (paediatric population or pediatric population).mp.	33. (puncture adj5 bite).mp.
4. or/1-3	34. (Forensic Dentistry or pathology).mp.
5. exp child abuse/	35. exp Forensic Dentistry/
6. (battered child or shaken baby or battered baby).mp.	36. "Bites"/ and "Stings"/di [Diagnosis]
7. child maltreatment.mp.	37. Tooth Fractures/ or Tooth Avulsion/
8. child protection.mp.	38. or/20-37
9. Child abuse.mp.	39. exp Photography, Dental/
10. or/5-9	40. (photography adj5 imag*).mp.
11. non-accidental injur:.mp.	41. (identi* adj3 forensic).mp.
12. physical abuse.mp.	42. (forensic adj3 photo*).mp.
13. (non-accidental: and injur:).mp.	43. (forensic adj3 imag*).mp.
14. soft tissue injur:.mp.	44. forensic imag*.mp.
15. dental trauma.mp.	45. forensic identification.mp.
16. dental injur:.mp.	46. Image Processing, Computer-Assisted/
17. oral trauma.mp.	47. or/39-46
18. (or/11-17) and 4	48. 19 and 38 and 47
19. 10 or 18	49. limit 48 to yr="2013-Current"
20. Tooth Injuries/	
21. (tooth or teeth).mp.	
22. animal bite:.mp.	
23. human bite:.mp.	
24. (adult bite or bite mark).mp.	
25. (bite or bites).mp.	
26. Bites, Human/	
27. odontology.mp.	

28. elliptical mark.mp.	
29. (Avulsion adj3 injur:).mp.	
30. avulsion injur:.mp.	

Fifteen databases were searched together with hand searching of particular journals and websites. A complete list of the resources searched can be found below.

Databases	Time period searched
ASSIA (Applied Social Sciences Index and Abstracts)	1987 – 2014
Child Data	1958 – 2009 [†]
CINAHL (<i>Cumulative Index to Nursing and Allied Health Literature</i>)	1982 – 2014
Cochrane Central Register of Controlled Trials	1996 – 2014
EMBASE	1980 – 2014
MEDLINE	1950 – 2014
MEDLINE In-Process and Other Non-Indexed Citations	1951 – 2014
Open SIGLE (System for Information on Grey Literature in Europe)	1980 – 2005 [*]
Pubmed E publications (Epub ahead of print)	2014
Scopus	2009 – 2014
Social Care online (previously Caredata)	1970 – 2014
Trip Plus	1997 – 2005 [†]
Web of Knowledge – ISI Proceedings	1990 – 2014
Web of Knowledge – ISI Science Citation Index	1981 – 2014
Web of Knowledge – ISI Social Science Citation Index	1981 – 2014
[*] ceased indexing [†] institutional access terminated [‡] no yield so ceased searching	
Journals 'hand searched'	Time period searched
Child Abuse and Neglect	1977 – 2014
Child Abuse Review	1992 – 2014

Websites searched	Date accessed
Child Welfare Information Gateway (formerly National Clearinghouse on Child Abuse and Neglect)	10 June 2014

Pre-review screening and critical appraisal

Papers found in the database and hand searches underwent three rounds of screening before they were included in this update. The first round was a title screen where papers that obviously did not meet the inclusion criteria were excluded. The second was an abstract screen where papers that did not meet the inclusion criteria based on the information provided in the abstract were excluded. In this round the pre-review screening form was completed for each paper. These first two stages were carried out by clinical experts. Finally a full text screen with a critical appraisal was carried out by members of the clinical expert sub-committee. Critical appraisal forms were completed for each of the papers reviewed at this stage. Examples of the pre-review screening and critical appraisal forms used in previous reviews are available on request (clinical.standards@rcpch.ac.uk).